

TITLE OF THE INVENTION

NETWORK ACCESS CONTROL METHOD, INFORMATION PROVIDING
APPARATUS, AND CERTIFICATE ISSUING APPARATUS FOR
NETWORK ACCESS

5 CROSS-REFERENCE TO RELATED APPLICATIONS

This application is based upon and claims the
benefit of priority from prior Japanese Patent
Application No. 2003-065409, filed March 11, 2003,
the entire contents of which are incorporated herein
10 by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a network access
control method, an information providing apparatus, and
15 a certificate issuing apparatus for network access.

2. Description of the Related Art

Accounting is important for an information
providing apparatus that uses the Internet and the
like. Presently, a direct deposit or credit-card
20 transactions are generally used for accounting
processes for Internet accesses. When making a
contract with an Internet service provider, a user
supplies the provider with his or her bank account
number or credit card number. In most cases,
25 the accounting is carried out monthly.

In recent years, some mobile devices such as Pads
and notebook personal computers have a wireless data

communication function using a cellular phone, PHS, and wireless LAN represented by IEEE802 and provided with a function to be connected to the Internet. There is available a hot spot service (registered trademark) as
5 a service for accessing to the Internet using these mobile devices. This service installs a wireless base station (access point) in a place where people gathers such as a coffee shop and enables access to the Internet from a mobile device in the shop.

10 Of systems using these mobile devices, many wireless LANs have no accounting infrastructure unlike infrastructures associated with communication common carriers such as cellular phones and PHs. Accordingly, applying the conventional method of monthly accounting
15 for Internet accesses to the wireless LAN greatly burdens both communication line providers and users. This is a big problem to medium and small enterprises that intend to provide the hot spot service. The RADIUS (Remote Authentication Dial-in User Service)
20 server, an access server for wireless LAN, has the accounting function. When a user actually pays the fee, the accounting function necessitates the user to enter his or her credit card number or clear an account at the cash register. Providing these facilities
25 increases costs for the communication line providers and users for providing the hot spot service. The present system needs to clear accounts manually.

An advantage of the hot spot service is providing temporary accesses. Therefore, applying the conventional monthly accounting to the hot spot service is impractical. The time-based accounting is desirable for providing charged temporary accesses. In most cases, manual operations are used to measure the time and collect bills for the accounting (e.g., see paragraphs 0034 through 0037 in Japanese Patent Application KOKAI Publication No. 2002-315058).

The accounting method described in this publication is embodied as follows. When a customer enters a hot spot, a shop assistant issues a receipt describing the authentication information. Using this information, the customer accesses the Internet. After finishing an access to the Internet, the customer requests the shop assistant to clear the bill. The shop assistant computes the usage time and the fee based on the usage time. Thereafter, the user clears the fee at the cash register.

In this manner, the conventional information providing service has made it difficult to perform accounting tasks for the temporary usage without manual operations.

BRIEF SUMMARY OF THE INVENTION

The present invention is directed to method and apparatus capable of charged temporary network access almost without manual operations.

According to an embodiment of the present invention, a network access control method comprises setting certificate information for each of user terminals, the certificate information including a user identification and access right information indicating a limited access right to a network; determining whether the user terminal is authenticated based on a user identification; and controlling access to the network in accordance with the certificate information when the user terminal is authenticated.

Additional objects and advantages of the present invention will be set forth in the description which follows, and in part will be obvious from the description, or may be learned by practice of the present invention.

The objects and advantages of the present invention may be realized and obtained by means of the instrumentalities and combinations particularly pointed out hereinafter.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate embodiments of the present invention and, together with the general description given above and the detailed description of the embodiments given below, serve to explain the principles of the present invention in which:

FIG. 1 shows a configuration of an information providing apparatus using a network access control method according to a first embodiment of the present invention;

5 FIG. 2 shows an example of certificate data used for the first embodiment;

FIG. 3 is a flowchart exemplifying a certificate issuing operation according to the first embodiment;

10 FIG. 4 is a flowchart exemplifying a network access operation according to the first embodiment;

FIG. 5 shows a modification of the certificate data;

FIG. 6 shows another modification of the certificate data; and

15 FIG. 7 shows yet another modification of the certificate data.

DETAILED DESCRIPTION OF THE INVENTION

20 An embodiment of a network access control method, an information providing apparatus, and a certificate issuing apparatus for network access according to the present invention will now be described with reference to the accompanying drawings.

[First embodiment]

25 FIG. 1 shows a configuration of the information providing apparatus using the network access control method and the certificate issuing apparatus according to the first embodiment of the present invention.

The embodiment uses a device 10 to receive information providing services. The device 10 is assumed to be a mobile device that has a wireless data communication function and can operate on batteries.

5 The device 10 may include a PDA and a notebook personal computer, but also a desktop personal computer which cannot operate on batteries.

The information providing apparatus comprises a certificate issuing device 12. The certificate issuing
10 device 12 may be installed not only near a wireless LAN access point 22, but also at any other locations convenient to users. The number of certificate issuing devices 12 and the wireless LAN access point 22 is not limited to one. It is preferable to provide
15 a plurality of certificate issuing devices 12.

The certificate issuing device 12 and wireless LAN access point 22 as well as an accounting client 28 are connected to the Internet 18 through a firewall 24b.

The embodiment comprises a basic certification
20 server 16, a RADIUS server 20, and an accounting server 26. The basic certification server 16, RADIUS server 20, and accounting server 26 are connected to the Internet 18 through a firewall 24a.

The certificate issuing device 12 issues a
25 certificate, i.e., a permission for accessing the Internet to a user. The certificate is electronically supplied as data to the user's mobile device 10 through

a medium. The medium may be a storage medium 13 or a transmission medium. Available storage media 13 include a memory card such as an SD (secure digital) card using flash memory, a floppy disk, and the like.

5 When the storage medium 13 is used, the mobile device 10 needs to have a slot for mounting the storage medium 13. The mobile device 10 reads data from the mounted storage medium 13. When a transmission medium is used, the mobile device 10 needs to include a memory. The
10 certificate data is written to the memory of the mobile device 10 via a serial connection such as USB, a wired or wireless network, an infrared data communication, and the like.

As shown in FIG. 2, the certificate data contains
15 a user ID (account) and expiration date data indicating an expiration date (access permission limit) of the certificate. The system is based on prepayment and specifies an expiration date corresponding to an amount the user prepaid. For example, the fee is set to
20 600 yen for a certificate valid for one day or to 1,000 yen for a certificate valid for two days.
The fee need not be always paid in cash. Credit-card transactions may be also available if the certificate issuing device 12 is provided with a credit-card
25 transaction function. The basic certification server 16 issues the user ID each time the certificate is issued.

Actually, the basic certification server 16 issues certificates. The certificate issuing device 12 simply receives certificate data from the basic certification server 16 and writes the data to a medium. Accord-
5 ingly, the certificate issuing device 12 is a sort of automatic dispenser. When the certificate is issued, the user is notified of a password for network access. The notification method includes displaying the password on a screen of the certificate issuing device
10 12, writing the password on a receipt, and the like.

The basic certification server 16 is a network certification server operated by a third party. A network authenticated by the basic certification server 16 is assumed to be reliable. The highest
15 reliability is attributed to the basic certification server 16. A typical administrative organization is VeriSign, Inc.

Though not shown, various information providing servers are connected to the Internet 18.

20 The wireless LAN access point 22 is an apparatus to relay network communication from the mobile device 10 to the RADIUS server 20. The wireless LAN access point 22 provides connection control in cooperation with the RADIUS server 20.

25 The RADIUS server 20 provides Internet access control for a user of the mobile device 10 based on the certificate data.

The firewalls 24a and 24b are an apparatus to guard the system against an unauthorized Internet access.

5 The following describes operations of the information providing apparatus in FIG. 1. The apparatus operations comprise a certificate issuing process and an Internet access control process.

FIG. 3 is a flowchart showing a process of the certificate issuing device 12.

10 In order to have a certificate, a user supplies the certificate issuing device 12 with a memory card 13 and a necessary fee (step S12). The fee may be paid in cash or by credit card. The certificate issuing device 12 sends the entered amount data to the basic
15 certification server 16 (step S14) and receives the user ID and the expiration date data corresponding to the prepaid amount from the basic certification server 16 (step S16). The basic certification server 16 stores a copy of the user ID and the expiration date
20 data passed to the certificate issuing device 12 (step S18). The certificate issuing device 12 writes the user ID and the expiration date corresponding to the fee onto the memory card 13 (step S20).

25 The basic certification server 16 accesses the RADIUS server 20 and requests the RADIUS server 20 to issue an user ID and password for network access. The certificate issuing device 12 has user interfaces

such as a display section, a printer, and the like.
The certificate issuing device 12 notifies the user
of the password and the user ID for wireless access
obtained from the RADIUS server 20 by displaying and
5 printing the same. This user ID for network access
may be the same as or differ from the user ID for the
certificate data.

FIG. 4 shows a process to access the network.
The user attaches the memory card 13 to the mobile
10 device 10. The certificate data has been written to
the memory card 13. The wireless LAN access point 22
issues an inquiry to mobile devices 10 within an access
area thereof. The mobile device 10 responds to the
inquiry and transmits certificate data to the wireless
15 LAN access point 22 (step S32). The wireless LAN
access point 22 transfers the certificate data
transmitted from the wireless LAN access point 22
to the RADIUS server 20 for user authentication
(step S34). The user authentication complies with
20 IEEE802.1x, i.e., a wireless LAN standard. The RADIUS
server 20 accesses the basic certification server 16.
Using a copy of the certificate issued to the client,
the RADIUS server 20 checks whether or not the
certificate issued to the client (user) is usable
25 (valid). If the user loses the certificate, the RADIUS
server 20 allows the basic certification server 16 to
invalidate the certificate. This can prevent the

certificate from being used by unauthorized users.

At step S36, it is determined whether or not the user authentication succeeds. If the user authentication fails, the process terminates. If the user authentication succeeds, it is determined at step S38 whether or not the certificate's expiration date is valid. If the expiration date has passed, the process notifies this state to the mobile device 10 at step S42 and then terminates. If the expiration date is valid, the process permits the user to access the Internet at step S40. The RADIUS server 20 reads the expiration date information in the certificate to determine validity of the expiration date. When this information becomes invalid, the RADIUS server 20 invalidates the account (access permission).

After the access is permitted, the accounting server 26 and accounting client 28 start an accounting process at step S44. At step S46, it is determined whether or not the access is within the maximum depositing amount. When the access is within the maximum depositing amount, the process continues the access. When the access exceeds the maximum depositing amount, the process terminates the access.

As mentioned above, according to the embodiment, a certificate assigned with the expiration date is issued corresponding to the prepaid fee. Accordingly, it is possible to easily provide charged temporary access to

the Internet without the need for an accounting infrastructure and attended services. When a plurality of corporations shares certificates, medium and small enterprises can easily provide temporary information services. The certificate issuing device 12 is available in an unattended manner and is not physically connected to the Internet 18. This makes it impossible to make connection to the Internet due to destruction and the like.

The present invention is not limited to the above-mentioned embodiment and may be embodied in various modifications. For example, while there has been described the accounting (expiration date) in units of days, it may be preferable to use the time or the amount of data as the unit. When the time is used as the unit, an item for the remaining accessible time is added to the certificate as shown in FIG. 5 and is specified correspondingly to the prepaid amount.

The RADIUS server 20 has an access time count function. Each time the access time has passed, the RADIUS server 20 decreases the remaining time. The RADIUS server 20 permits the access until the remaining time reaches 0 within the expiration date. When the amount of data is used as the unit, the remaining amount of accessible data is likewise added to the certificate as shown in FIG. 6 and is specified correspondingly to the prepaid amount. In this case, the RADIUS server 20 has an

access data amount measuring function. Each time the specified amount of data is accessed, the RADIUS server 20 decreases the remaining amount of data. The RADIUS server 20 permits the access until the remaining amount of data reaches 0 within the expiration date.

When the day or time is used as the unit, it may be preferable to specify the number of days or the time from the start of access instead of specifying the expiration date and time. In this case, the time count function of the RADIUS server 20 is used to count the number of days or the time that has passed from the start of access.

The above-mentioned description concerns examples of recording the number of days, the time, and the amount of data corresponding to the prepaid amount. As shown in FIG. 7, it is possible to record the prepaid amount itself. In this case, the RADIUS server 20 converts the access time or the amount of data into the amount. The RADIUS server 20 decreases the amount for each specified access time or each specified amount of access data. The RADIUS server 20 permits the access until the remaining amount reaches 0 within the expiration date.

The above embodiment relates to a certificate indicating that a predetermined amount is paid. It is possible to issue a certificate of a predetermined right. For example, the certificate may represent

a movie ticket for a predetermined date, an admission ticket for a park or a commutation ticket. In this case, if it is determined that the user authentication succeeds at step S36 in FIG. 4, it is determined

5 whether or not the right is valid instead of whether or not the certificate's expiration date is valid at step S38. When the user purchases the right, a graphical user interface is provided to display a right selection menu on the terminal device.

10 Further, the prepaid amount may be used to purchase a merchandise in addition to access a network. That is, the terminal device having a certificate can be used as an electronic wallet. At the time of shopping, an amount of bill is displayed on the
15 terminal device at a cash register, and if the user approves the amount the prepaid amount is decreased by the amount. This is equally applied to an electronic mall in the Internet.

The wireless LAN access point 22 can know the
20 location of the mobile terminal 10. Therefore, it is possible to form a database storing a list of goods purchased and a walking route in a shop for each user and provide promotion information to a user based on the contents of the database depending on the location
25 of the user (mobile terminal 10).

The present invention may be embodied as a computer-readable recording medium that records a

program to allow a computer to execute specified means.

While the description above refers to particular
embodiments of the present invention, it will be
understood that many modifications may be made without
5 departing from the spirit thereof. The accompanying
claims are intended to cover such modifications as
would fall within the true scope and spirit of the
present invention. The presently disclosed embodiments
are therefore to be considered in all respects as
10 illustrative and not restrictive, the scope of the
invention being indicated by the appended claims,
rather than the foregoing description, and all changes
that come within the meaning and range of equivalency
of the claims are therefore intended to be embraced
15 therein. For example, the present invention can be
practiced as a computer readable recording medium in
which a program for allowing the computer to function
as predetermined means, allowing the computer to
realize a predetermined function, or allowing the
20 computer to conduct predetermined means.

As mentioned above, the present invention provides
a network access control method and an information
providing system capable of charged temporary network
access almost without manual operations.